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Vested, Malene Hovgaard; Carstensen, Stefan; Christensen, Erik Damgaard

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PIV measurements of velocities and accelerations under breaking waves on a slope

Malene Vested, Stefan Carstensen, and Erik Damgaard Christensen

Section of Fluid Mechanics, Coastal and Maritime Engineering, Department of Mechanical Engineering, Technical University of Denmark, Denmark, mlhv@mek.dtu.dk

Understanding the physics of breaking waves is an ongoing research topic, not only due to human curiosity, but also due to the influence breaking waves have on offshore structures. In recent years, the development in experimental methods has facilitated a new insight into the physics of breaking waves. In this study, we have investigated the wave kinematics under steep and breaking waves on a laboratory beach with a slope of $1/25$. The velocity field was measured by use of Particle Image Velocimetry (PIV) at a sample rate of 96Hz. The high sample rate allowed for the accelerations to be determined directly from the sampled velocities. It was found that both velocities and accelerations differ from the ones predicted from common wave theories such as streamfunction theory. This was especially evident at the top part of the wave close to the surface. This was not surprising, since the breaking event is a highly non-linear process. The results presented here may facilitate computations of the impact force on offshore structures and furthermore be used for validation of CFD models while altogether shedding light on the mechanisms behind breaking waves.